



ENDOSCOPIC SURGERY IN ATELECTATIC MIDDLE EAR..

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ABSTRACT

Objective: To study the role of ventilation tubes in tympanoplastic reconstruction of atelectatic middle ear.
Design: Prospective study

Setting: A tertiary care hospital.

Materials and Methods: The study was carried out in the department of ENT at ESIC Medical College and Hospital, Faridabad. 25 patients of atelectatic middle ear were included in the study. A grommet was placed in the residual tympanic membrane or within the new temporalis fascia graft. Patients were followed up for 1 year.

Results: Middle ear space could be achieved in 21 cases (84%). In 6 cases, Eustachian tube function improved and air could be seen coming through the grommet while in rest of 19 cases, eustachian tube still remained non-functioning. 15 of the 19 cases where ossiculoplasty was done showed hearing improvement.

Conclusion: The use of ventilation tubes in cases of atelectatic ears during tympanoplasty is feasible and helps to reconstruct the middle ear space, thus preventing the collapse of the drum as well as retraction pocket formation.

KEYWORDS : atelectatic middle ear, grommet, ventilation tube

Introduction

Atelectatic middle ear constitutes a common cause of deafness in the practice of Otolaryngology. Various studies have been carried out and hypothesis put forward for the pathogenesis and treatment of the disease but still the treatment has remained a challenge. Poor eustachian tube function alone, is not a sufficient factor to cause collapse of the tympanic membrane. Destruction of the architecture of the tympanic membrane is a complementary factor and this seems to be secondary to long standing middle ear inflammation. Sade and Berco demonstrated this fact on histological examination of tympanic membrane seen in such ears¹. The drum becomes atrophic and loses its elasticity due to loss of lamina propria. It may be seen in various stages of retraction as described by Sade.

The tympanum gets obliterated due to the formation of adhesions between the drum and promontory. Pockets in the tympanum may be filled with mucous, cysts or cholesterol granulomas. In some cases Eustachian tube may be blocked by retracted drum, cysts, adhesions or mucous secretions

Ossicular fixation is common in atelectatic ears. Malleus may be adherent to the promontory, lateral wall or roof of tympanum. Incus may show adhesions and necrosis of long process. Sometimes a fibrous band may replace the long process which extends to the stapes head. This necrosis occurs due to osteitis or pressure necrosis secondary to wrapping of lenticular process by collapsed drum² or due to the activity of enzyme, collagenase³. The pneumatic cell system of the mastoid shows intense mucosal edema followed by secondary sclerosis, which is evident radiologically.

Inner ear involvement is common in early stages of adhesive otitis. It is due to toxic serous labyrinthitis. Fluid in the mastoid air cells act as foci of allergen leading to development of allergic labyrinthine hydrops. This may account for sensory neural deafness.

Materials and Methods

25 cases of atelectatic middle ear were taken up for study. Each patient was subjected to (a) detailed history, (b) clinical and radiological examination, (c) hearing assessment by pure tone audiometry and other special tests (if required), (d) status of eustachian tube function (e) assessment under operating microscope. Particular attention was paid to causes for eustachian

tube dysfunction such as nasal allergy, nasal obstruction, adenoids, sinusitis and tonsillar infections.

Ear was examined for retraction of tympanic membrane, atrophy, postero-superior retraction pockets, mobility of tympanic membrane and tuning fork tests. Note was made of the growth of squamous epithelium into retraction pockets, cholesteatoma formation and discharge. Eustachian tube function was tested by asking the patient to perform Valsalva manoeuvre and Toynbee test. A high resolution CT scan was done to look for destruction in the key area whenever a cholesteatoma was suspected in postero-superior retraction pocket.

Each patient was subjected to pure-tone audiometry and impedance audiometry was done in some cases.

The patients having atelectatic ears with partial (Fig1) or total collapse (Fig2) of the tympanic membrane, having a conductive hearing loss with good cochlear reserve and malfunctioning Eustachian tube were subjected to tympanoplasty. Our prime aim was to create a middle ear space, strengthen the tympanic membrane, improve the aeration by ventilating tube and reconstruct the hearing at the same stage or defer it to a second stage, in cases where it was not possible to do ossicular reconstruction in the first stage.



Fig 1. Atelectatic middle ear showing partial collapse of the tympanic membrane with tymanosclerotic patches at the periphery.



Fig 2. Total collapse of the tympanic membrane. Fibrous adhesions were found between the handle of malleus and promontory intraoperatively.

Operative technique

The patients were operated by transcanal endoscopic approach or by post aural approach. In the endoscopic approach, an incision was given 6mm from the annulus. The tympanomeatal flap was raised, carefully lifting the thin atrophic drum attached to the promontory, ossicles, round window niche or facial recess. The middle ear adhesions were broken and drum was further elevated till eustachian tube area was visualised. Adhesions binding the ossicles to the middle ear were broken and ossicular chain was mobilized. In those cases where the long process of incus was necrosed or formed a fibrous band, the incus was removed, refashioned and used as an autograft between malleus handle and stapes head. Angled endoscopes aid in visualization of the area around ossicles and aditus quite clearly thus reducing the need for drilling or curetting the posterior canal wall. The area of protympanum and Eustachian tube was also visualised. Adhesions were removed from the region of Eustachian tube. Temporalis fascia harvested by a separate scalp incision at the beginning of surgery was used as an inlay graft deep to the drum epithelium. The medial wall of middle ear was covered by a crescent of silastic sheet (.005" thickness) which extended from opening of the Eustachian tube to the round window niche. A Teflon grommet was inserted through the tympanic membrane anteriorly or antro-inferiorly where tympanic membrane remnant was intact and middle ear space could be found. In some cases, the grommet was placed through a slit in the temporalis fascia and the assembly of temporalis fascia and grommet was placed as a graft. The portion of epithelium which came around the grommet opening was removed. In some cases, the grommet was placed between the edge of the remnant of tympanic membrane anteriorly and the edge of fascia graft.

Observation and Results

The present study was conducted on 25 clinically proved cases of atelectatic middle ear. The youngest patient was 11 years old and the oldest was 40 years old. There were 14 males (56%) and 11 females (44%). All 25 patients presented with conductive hearing loss. 4 of them also complained of tinnitus.

The tympanic membrane was thin and atrophic in all the cases. In 1 case, there were tympanosclerotic patches in the periphery of the drum remnant. 20 cases showed total collapse of the tympanic membrane (80%) and 5 cases (20%) showed partial collapse. In 22 cases, atelectasis was of grade IV i.e. tympanic membrane was thin and atrophic, completely plastered over the promontory and invaginating around the ossicles. It could not be lifted with a suction tip because of adhesions between the drum and promontory. 3 cases (12%) showed grade III atelectasis where tympanic membrane was collapsed, but it could be lifted up with a suction tip, indicating absence of adhesions underneath. Siegalization indicated no mobility of the tympanic membrane in 22 (88%) cases, while in the rest restricted mobility could be appreciated.

Eustachian tube function: Valsalva and Toynbee test did not show any change in the tympanic membrane or any air entry into the middle ear in 23 cases (92%), while in 2 cases (8%) there was

suggestion of air entry.

Hearing assessment: Puretone audiometry showed air bone gap exceeding 30 decibels in 8 cases. 20 cases (80%) had air conduction loss exceeding 30 decibels while only in 5 cases (20%), the loss was between 11-30 decibels.

CT scan showed evidence of poor pneumatization in 23 of the 25 cases, and this fact correlates well with the function of the Eustachian tube.

Operative Findings:

All cases were subjected to surgery. The following findings were noted.

Incus was necrosed in 12 cases (48%) and necrosis was confined to the lenticular process and distal part of the long process. In 4 cases (16%) there was necrosis of incus and head and neck of stapes. In one case (4%), the incus and malleus were destroyed while stapes was intact and mobile. In rest of the cases (32%) ossicular chain was intact and mobile. Thus 17 cases (68%) showed various grades of ossicular chain necrosis. This high figure in our series is due to a large number of cases belonging to grade IV atelectasis.

Adhesions between drum and promontory were seen in 22 cases (88%). Malleus was severely retracted and found adherent to the promontory by a thick fibrous band in 18 cases (72%)

Secretions: 7 out of 25 patients showed thick discharge on tympanotomy. It was seen to come from the aditus deep to the incus and could be sucked with difficulty. In cases where incus was necrosed, and removed to reconstruct, it was easier to suck and clear the secretions. Loculated glue was also seen deep to the handle of malleus in the attic region. This finding lends support to the pathogenesis that adhesive otitis media leads to secretory otitis media.

The use of endoscope aided in visualisation of the tympanic end of the eustachian tube in all cases. It was normal in 15 cases while granulations were seen in 3, fibrous adhesions 3, hypertrophic mucosa in 4 cases. Eustachian tube area was cleared by removal of obstructing cause and covered with silastic sheet.

The 25 cases of atelectatic ear were categorised into 3 groups.

Group 1 consisted of patients with intact and mobile ossicular chain or where mobility of ossicles could be achieved by lysis of adhesions. There were 8 cases in this group. In these cases tympanic membrane was strengthened by temporalis fascia and medial wall of middle ear was covered with silastic sheet and grommet was inserted for ventilation.

Group 2 consisted of 11 cases where ossicular chain showed different degree of ossicular necrosis. They were treated like group 1. In addition the ossicular chain was reconstructed. In 4 cases, homograft incus was used. In 5 cases, autograft incus was used. Cortical bone graft and tragal cartilage was used in 1 case each.

Group 3 consisted of 6 cases where middle ear was reconstructed like group 1 but ossicular reconstruction was deferred to a second stage.

In all the cases ventilation tube in the form of grommet was put during the surgery. In 13 cases, grommet was put through the remnant of tympanic membrane. In 10 cases, it was put through the temporalis fascia graft as there was no space available in the remnant of tympanic membrane to place a grommet. In 2 cases, grommet was placed between the graft and edge of remnant of tympanic membrane.

The commonest complication of ventilation tube was discharge

from the ear. In 64% of cases, discharge was in the first month. Discharge could be controlled with topical ear drops and by the third month, 80% of ears were dry. The presence of discharge did not interfere with graft healing. It is presumed that aerobic organisms which lay dormant in these atelectatic middle ears become activated when ventilation is provided and thus middle ear starts discharging¹ Blocking of the grommet with a crusty discharge was the next common complication. Therefore periodic suction and removal of crusts is mandated². Spontaneous extrusion of the grommet occurred in 4 cases in the first 3 months. The grommet was reinserted.

There was no case of migration of the grommet in the middle ear.

When the grommet was inserted through the remnant of the tympanic membrane, the graft healing was quick and good. In 2 cases, where the grommet was put between the graft and the tympanic membrane, there was delayed healing, infection and the edge of the temporalis fascia migrated medially towards the promontory, with extrusion of the grommet.

Discussion:

In group 1, all the 8 cases showed graft uptake. Middle ear space was created. All these cases showed a very good improvement in hearing postoperatively. Average air conduction loss was reduced to 22.7 decibels. 3 cases showed patent Eustachian tube on valsalva. In group 2, there were 11 cases. Ossiculoplasties were done as 1st stage procedure The ossicular reconstruction was done using incus homograft in 4, autograft in 5, cortical bone in 1 and tragal cartilage

in 1 case. Only 2 cases had air-bone gap of 21-30 decibels showing an improvement in 5 cases. Graft take up was good in 10 cases. The posterior part of the drum with the ossicular chain reconstruction remained intact. This patient had an average air conduction of 33 decibels in the frequency range of 500-2000 Hz. Postoperatively he had a gain of 10 decibels reducing the air conduction loss to 23 decibels. Middle ear space was fully created in 8 cases while in 2 cases there was collapse of the graft anteriorly in one and posteriorly in the other. A third case had a breakdown of the graft. There was retraction pocket formation in 2 cases because the drum had collapsed. There was reformation of adhesions in 1 case inspite of the grommet being in place.

Only one case showed positive valsalva manoeuvre indicating patent tube. In the rest of the 10 cases Eustachian tube was not functioning.

Group 3 included 6 cases. Here the middle ear was reconstructed, except ossiculoplasty which was postponed to a second stage. Pre and post operative air conduction and A-B gap is shown in the table. In all the 6 cases, graft had taken well and was epithelised. Middle ear space was formed in 5 cases.

Overall, the graft took well in 24 of the 25 cases with breakdown in 1 case. Middle ear space was created in 21 cases, 3 cases had collapse of reconstructed drum and one case showed rejection of the graft. No retraction was seen in 21 cases though 3 cases had partial collapse and 1 case showed reformation of adhesions. Eustachian tube function improved in 6 cases while in 19 cases, tube remained non-functioning. The results of surgery are tabulated in Table 1.

TABLE 1: RESULTS OF SURGERY

Group	Range (decibels)	Preoperative hearing loss		Post-operative hearing loss		Graft take		Creation of middle ear space		Retraction pocket		ET function	
		A-B gap	Air conduction	A-B gap	Air conduction	Accept	Reject	Present	Absent	Present	Absent	Present	Absent
1	0-10	-	-	5	1								
	11-20	4	1	3	4								
	21-30	3	4	-	2								
	31-40	1	1	-	-								
	>40	-	2	-	1								
TOTAL		8				8	none	8	none	none	8	3	5
2	0-10	-	-	2	-								
	11-20	1	-	4	1								
	21-30	7	-	2	3								
	31-40	3	8	3	3								
	>40	-	3	-	4								
TOTAL		11				10	1	8	2(partial)	2	8	1	10
3	0-10	-	-	-	-								
	11-20	-	-	2	-								
	21-30	2	-	1	-								
	31-40	4	2	3	4								
	>40	-	4	-	2								
TOTAL		6				6	-	5(partial)	1	1	5	2	4
TOTAL						24	1	21	3	3	21	6	19

Conclusion:

The present study involving reconstruction of atelectatic drum with grommet placement was gratifying. It showed good results with creation of the middle ear space and improved Eustachian tube function. Our results indicate that the use of ventilation tubes in cases of atelectetic ears during tympanoplasty surgery is feasible and helps to reconstruct the space, thus preventing the collapse of the drum as well as retraction pocket formation. The grommet can be placed in the residual tympanic membrane or the neo-tympanum with no difficulty in graft uptake. Though complications such as discharge, crusting and formation of tympanosclerosis are common, it still provides better hearing outcomes, especially in the first three months⁶. A thin sialastic sheet maintains the middle ear space and helps the graft to heal. Angled endoscopes provide clear and magnified views of the tympanum, ossicles, aditus and

Eustachian tube area without the need for drilling the posterior canal wall and can greatly enhance decision making and outcomes.

Conflict of interest: none

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